4 PRACTICE AND APPLY

Assignment Guide

Answer Transparencies available for all exercises

Basic:
Day 1: pp. 533–536
Exs. 1–12, 49–55
Day 2: pp. 533–536
Exs. 15–24, 31–34, 37–48

Average:
Day 1: pp. 533–536
Exs. 1, 2, 4–13, 49–55
Day 2: pp. 533–536
Exs. 17–20, 24–29, 31–35, 37–48

Advanced:
Day 1: pp. 533–536
Exs. 1, 2, 5–14, 49–55
Day 2: pp. 533–536
Exs. 19–22, 24–48*

Block:
pp. 533–536
Exs. 1, 2, 4–13, 17–20, 24–29, 31–35, 37–55

Differentiated Instruction

See *Algebra 2 Best Practices Toolkit* for suggestions on addressing the needs of a diverse classroom.

Homework Check

For a quick check of student understanding of key concepts, go over the following exercises:

Basic: 4, 12, 16, 24, 31

Average: 6, 13, 18, 25, 32

Advanced: 8, 14, 20, 26, 33

Extra Practice

- Student Edition, p. 1016
- Chapter 7 Resource Book: Practice levels A, B, C, pp. 76–78

Practice Worksheet

An easily-readable reduced practice page (with answers) for this lesson can be found on p. 476C.

EXAMPLE 4 B on p. 531 for Exs. 15–22

WRITING POWER FUNCTIONS Write a power function $y = ax^b$ whose graph passes through the given points.

15. (4, 3), (8, 15) $y = 0.12x^{2.32}$
16. (5, 9), (8, 34) $y = 0.0950x^{2.83}$
17. (2, 3), (6, 12) $y = 1.25x^{1.26}$
18. (3, 14), (9, 44) $y = 4.45x^{1.04}$
19. (4, 8), (8, 30) $y = 0.569x^{1.91}$
20. (5, 10), (12, 81) $y = 0.214x^{2.39}$
21. (4, 6.2), (7, 23) $y = 0.241x^{2.34}$
22. (3.1, 5), (6.8, 9.7) $y = 1.93x^{0.844}$

EXAMPLE 5 on p. 532 for Exs. 23–26

FINDING POWER MODELS Use the given points (x, y) to draw a scatter plot of the points $(\ln x, \ln y)$. Then find a power model for the data. 23–26. See margin for art.

23. (1, 0.6), (2, 4.1), (3, 12.4), (4, 27), (5, 49.5) $y = 0.606x^{2.74}$
24. (1, 1.5), (2, 4.8), (3, 9.5), (4, 15.4), (5, 22.3) $y = 1.50x^{1.68}$
25. (1, 2.5), (2, 3.7), (3, 4.7), (4, 5.5), (5, 6.2) $y = 2.50x^{0.567}$
26. (1, 0.81), (2, 0.99), (3, 1.11), (4, 1.21), (5, 1.29) $y = 0.810x^{0.289}$

27. ★ **MULTIPLE CHOICE** Which equation is equivalent to $\log y = 2x + 1$? **A**

Ⓐ $y = 10(100)^x$ Ⓑ $y = 10^x$ Ⓒ $y = e^{2x+1}$ Ⓓ $y = e^2$

ERROR ANALYSIS *Describe* and correct the error in writing y as a function of x.

28. The third step should be multiplication, not addition; $y = e^{2x} \cdot e^1 = (e^2)^x \cdot e$, $y = 2.72(7.39)^x$.

$\ln y = 2x + 1$
$y = e^{2x+1}$
$y = e^{2x} + e^1$
$y = (e^2)^x + e$
$y = 7.39^x + 2.72$

29. The x should be raised to the 3, not multiplied by it; $\ln y = \ln x^3 - 2$, $y = e^{\ln x^3 - 2}$, $y = e^{\ln x^3} \cdot e^{-2}$, $y = 0.135x^3$

$\ln y = 3 \ln x - 2$
$\ln y = \ln 3x - 2$
$y = e^{\ln 3x - 2}$
$y = e^{\ln 3x} \cdot e^{-2}$
$y = (3x)(0.135) = 0.405x$

C 30. **CHALLENGE** Take the natural logarithm of both sides of the equations $y = ab^x$ and $y = ax^b$. What are the slope and y-intercept of the line relating x and $\ln y$ for $y = ab^x$? of the line relating $\ln x$ and $\ln y$ for $y = ax^b$? $\ln b$, $\ln a$; b, $\ln a$

PROBLEM SOLVING

GRAPHING CALCULATOR You may wish to use a graphing calculator to complete the following Problem Solving exercises.

EXAMPLES A **2, 3, 5, and 6** on pp. 530–533 for Exs. 31–35

31. **BIOLOGY** Scientists use the circumference of an animal's femur to estimate the animal's weight. The table shows the femur circumference C (in millimeters) and the weight W (in kilograms) for several animals.

Animal	Giraffe	Polar bear	Lion	Squirrel	Otter
C (mm)	173	135	93.5	13	28
W (kg)	710	448	143	0.399	9.68

a. Draw a scatter plot of the data pairs $(\ln C, \ln W)$. See margin.
b. Find a power model for the original data. $y = 0.000466x^{2.80}$
c. Predict the weight of a cheetah if the circumference of its femur is 68.7 millimeters. about 64.8 kg

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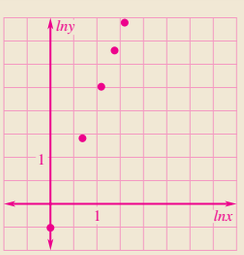
○ = WORKED-OUT SOLUTIONS on p. WS1

★ = STANDARDIZED TEST PRACTICE

23.


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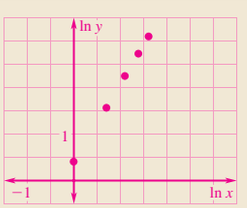

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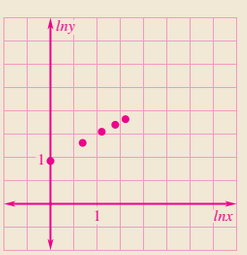

33b. Graph the points (x, y) if they appear linear, then a line is the best fit. If not, graph the points $(x, \ln y)$, if these points appear linear, then an exponential model is the best fit for the data. If not, graph the points $(\ln x, \ln y)$ if these points appear linear, then a power model is the best fit for the data; $y = 33.8x + 28$.

32. ASTRONOMY The table shows the mean distance x from the sun (in astronomical units) and the period y (in years) of six planets. Draw a scatter plot of the data pairs $(\ln x, \ln y)$. Find a power model for the original data.

See margin for art; $y = x^{1.50}$.

Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn
x	0.387	0.723	1.000	1.524	5.203	9.539
y	0.241	0.615	1.000	1.881	11.862	29.458

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33. ★ SHORT RESPONSE The table shows the numbers of business and non-business users of instant messaging for the years 1998–2004.

Years since 1997	1	2	3	4	5	6	7
Business users (in millions)	1	2	5	7	20	40	80
Non-business users (in millions)	55	97	140	160	195	235	260

a. Find an exponential model for the number of business users over time. $y = 0.475(2.08)^x$

b. *Explain* how to tell whether a linear, exponential, or power function best models the number of non-business users over time. Then find the best-fitting model.

B

34. MULTI-STEP PROBLEM The boiling point of water increases with atmospheric pressure. At sea level, where the atmospheric pressure is about 760 millimeters of mercury, water boils at 100°C. The table shows the boiling point T of water (in degrees Celsius) for several different values of atmospheric pressure P (in millimeters of mercury).

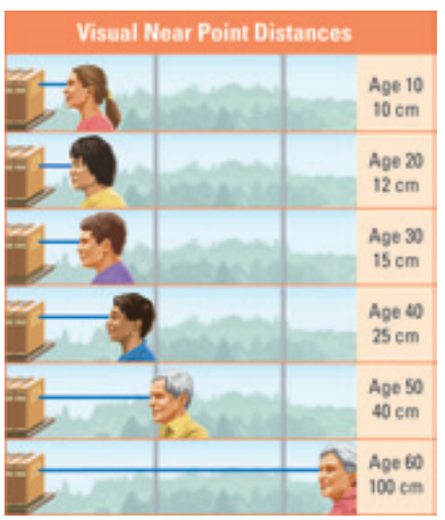
P	T
149	60
234	70
355	80
526	90
760	100
1075	110

a. Graph Draw a scatter plot of the data pairs $(\ln P, \ln T)$. See margin.

b. Model Find a power model for the original data. $T = 13.1(P)^{0.306}$

c. Predict When the atmospheric pressure is 620 millimeters of mercury, at what temperature does water boil? about 93.7°C

35. ★ EXTENDED RESPONSE Your visual *near point* is the closest point at which your eyes can see an object distinctly. Your near point moves farther away from you as you grow older. The diagram shows the near point y (in centimeters) at age x (in years).



a. Graph Draw a scatter plot of the data pairs $(x, \ln y)$. See margin.

b. Graph Draw a scatter plot of the data pairs $(\ln x, \ln y)$. See margin.

c. Interpret Based on your scatter plots, does an exponential function or a power function best fit the original data? *Explain* your reasoning.

d. Model Based on your answer for part (c), write a model for the original data. Use your model to predict the near point for an 80-year-old person. $y = 4.98(1.05)^x$; about 247 cm

35c. Exponential function; the points for $(x, \ln y)$ appear more linear than the points $(\ln x, \ln y)$, so an exponential model appears to be the best fit for the data.

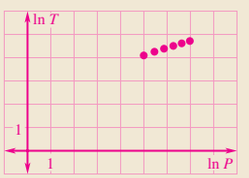
Avoiding Common Errors

Exercises 5–8 In each of these exercises, students should obtain an equation of the form "a number" $= b^2$ in one of the steps of the solution. For example, in Exercise 7 this equation is $25 = b^2$. The next step is to find the value of b, the base for the exponential model. Some students may write both square roots, for example, $b = \pm 5$ in Exercise 7. Explain to these students that, although they are correct that the quadratic equation has two solutions, only the positive square root applies here because the base of an exponential function must be a positive number other than 1. (If necessary, refer students back to the definition of an exponential function at the beginning of Lesson 7.1 on page 478.)

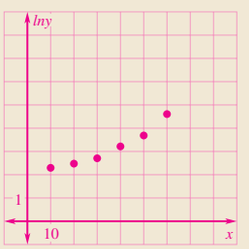
Internet Reference

Exercise 32 Additional information about the planets in our solar system can be found at the website solarsystem.nasa.gov/planets/index.cfm

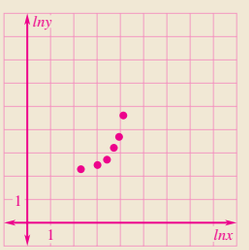
34a.



35a.



35b.



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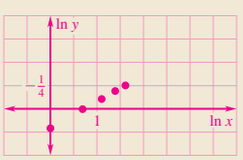
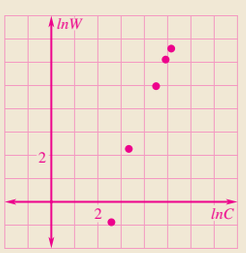


31a.



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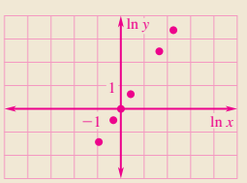

5 ASSESS AND RETEACH

Daily Homework Quiz

Transparency Available

1. Write an exponential function $y = ab^x$ whose graph passes through (2, 48) and (4,768). $y = 3 \cdot 4^x$.

2. Find an exponential model for the data in the table.

x	1	2	3	4	5
y	35	64	112	205	376

$y = 19.4(1.81)^x$

3. Write a power function $y = ax^b$ whose graph passes through (3, 8) and (6, 35). $y = 0.77x^{2.13}$

4. Find a power model for the data in the table.

x	3	6	10	15	19
y	1	5	15	41	70

$y = 0.08x^{2.3}$

Online Quiz

Available at **classzone.com**

Diagnosis/Remediation

- Practice A, B, C in Chapter 7 Resource Book, pp. 76–78
- Study Guide in Chapter 7 Resource Book, pp. 79–80
- Practice Workbook, pp. 120–121
- @HomeTutor

Challenge

Additional challenge is available in the Chapter 7 Resource Book, p. 83.

Quiz

An easily-readable reduced copy of the quiz (with answers) on Lessons 7.6–7.7 from the Assessment Book can be found on p. 476E.

C **36. CHALLENGE** A doctor measures an astronaut's pulse rate y (in beats per minute) at various times x (in minutes) after the astronaut has finished exercising. The results are shown in the table. The astronaut's resting pulse rate is 70 beats per minute. Write an exponential model for the data. $y = 148(0.94)^x$

x	0	2	4	6	8	10	12	14
y	172	132	110	92	84	78	75	72

MIXED REVIEW

PREVIEW
Prepare for Lesson 8.1 in Exs. 37–42.

The variables x and y vary directly. Write an equation that relates x and y. *(p. 107)*

37. $x = 6, y = 48$ $y = 8x$ **38.** $x = -7, y = 28$ $y = -4x$ **39.** $x = 10, y = 6$ $y = \frac{3}{5}x$

40. $x = 35, y = 15$ $y = \frac{3}{7}x$ **41.** $x = 0.3, y = 1.2$ $y = 4x$ **42.** $x = 12, y = 15$ $y = \frac{5}{4}x$

Graph the function. State the domain and range. *(p. 492)* **43–48. See margin.**

43. $y = e^{-3x}$ **44.** $y = 4e^x$ **45.** $f(x) = 2e^{2x} + 1$

46. $y = e^{-x} - 4$ **47.** $y = 2e^{x-2}$ **48.** $g(x) = 0.5e^{x+1} + 3$

Condense the expression. *(p. 507)*

49. $3 \log_7 4 - \log_7 8$ $\log_7 8$ **50.** $2 \log 5 + \log 4$ $\log 100$, or 2 **51.** $\ln x + 9 \ln y$ $\ln xy^9$

52. $2 \ln 6 - 3 \ln x$ $\ln \frac{36}{x^3}$ **53.** $\log_5 7 + 6 \log_5 x - \log_5 3$ $\log_5 \frac{7x^6}{3}$ **54.** $\log 8 - 2 \log 2 + 4 \log x$ $\log 2x^4$

55. PIZZA A pizza costs \$11 plus \$2 per topping. You have \$18. Use an inequality to find the maximum number of toppings you can order. *(p. 41)* $11 + 2x \leq 18$

QUIZ *for Lessons 7.6–7.7*

Solve the equation. Check for extraneous solutions. *(p. 515)*

1. $2^{x+1} = 16^{x+2}$ $-\frac{7}{3}$ **2.** $e^{-x} = 4$ about -1.386 **3.** $3^{2x} + 5 = 13$ about 0.946

4. $3^{x+1} - 5 = 10$ about 1.465 **5.** $\log_4 (4x + 7) = \log_4 11x$ 1 **6.** $\ln (3x - 2) = \ln 6x$ no solution

7. $\log_3 x = -1$ $\frac{1}{3}$ **8.** $6 \ln x = 30$ about 148.41 **9.** $\log_2 (x + 4) = 5$ 28

Write an exponential function $y = ab^x$ whose graph passes through the given points. *(p. 529)*

10. (1, 5), (2, 30) $y = \frac{5}{6}(6)^x$ **11.** (1, 4), (2, 32) $y = \frac{1}{2}(8)^x$ **12.** (2, 15), (3, 45) $y = \frac{5}{3}(3)^x$

Write a power function $y = ax^b$ whose graph passes through the given points. *(p. 529)*

13. (4, 8), (9, 23) $y = 1.32x^{1.30}$ **14.** (3, 12), (10, 36) $y = 4.40x^{0.912}$ **15.** (5, 4), (11, 51) $y = 0.0222x^{3.23}$

16. BIOLOGY The average weight y (in kilograms) of an Atlantic cod from the Gulf of Maine can be modeled by $y = 0.51(1.46)^x$ where x is the age of the cod (in years). Estimate the age of a cod that weighs 15 kilograms. *(p. 515)* about 9 yr

EXTRA PRACTICE for Lesson 7.7, p. 1016 **ONLINE QUIZ** at classzone.com

43–48. See Additional Answers beginning on p. AA1.